



## The design and psychometric assessment of a child-friendly TPB-based questionnaire

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**Title:** The design and psychometric assessment of a child-friendly TPB based questionnaire.

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## Abstract

**Background:** Despite the popularity of the Theory of Planned Behaviour (TPB) a lack of research assessing the efficacy of the model in understanding the health behaviour of children exists. The aim of this study was to develop and test a TPB based measure suitable for use with schoolchildren aged 9-10 years. **Methods:** A mixed method sequential design was employed. In Phase 1, semi-structured focus group discussions were conducted to elicit the underlying beliefs specific to tooth brushing. Using content thematic analysis the beliefs were identified and a TPB measure was developed. A repeated measures design was employed in phase 2 using test re-test reliability analysis in order to assess its psychometric properties. In all, 184 children completed the questionnaire. **Results:** The questionnaire proved to be reliable for assessing the tooth brushing beliefs of children. Pearson's product moment correlations were calculated for all of the TPB constructs, achieving substantial to almost perfect agreement levels, providing strong predictive power of the TPB. **Conclusions:** The design and development of the measure are described, which could serve as a guide to fellow researchers and health professionals interested in using theoretical models to investigate the health and wellbeing of children.

## **Introduction**

Within society, health and the establishment of health promoting behaviours are essential particularly among children given that behaviours adopted early in life are more likely to be continued throughout adolescence and into adulthood (World Health Organization; WHO, 2003). In fact, it has been suggested that providing children with skills to improve knowledge, attitudes and ultimately behaviour to enable them to make healthy decisions, increases the likelihood of establishing healthy lifetime habits (Kwan, Petersen, Pine & Borutta, 2005; WHO, 2003). However, in order to promote behaviour change among child populations, there is firstly a need to understand how personal and environmental determinants affect behaviour which then in turn enables effective health-related behaviour change interventions to be designed and implemented (Adair, Burnside & Pine, 2013). To date, health promotion initiatives have often been reinforced within the school setting not only for the benefit of assessing large numbers of children, but to also ensure that through them their families and wider communities can also be reached (WHO, 2003). Moreover, it has been shown that behaviour change is often more successful at school, under teacher guidance than at home under parental influences (Stewart, Sun, Patterson, Lemerie & Hardie, 2004).

The Theory of Planned Behaviour (TPB) (Ajzen, 1985) has emerged as a popular conceptual framework for the study of human behaviour and the development of successful behaviour change interventions (Hardeman et al., 2002). Whilst much supportive evidence has been obtained for the efficacy of the TPB as a predictor of both intention and behaviour (Armitage & Conner, 2001, Godin & Kok, 1996), and for the success of the theory in providing a framework for health behaviour-change interventions, a lack of TPB-based research with children under 13 years exists. It has been suggested that one of the reasons the TPB has not been used to any great extent with children, is that it is a difficult model to operationalise

(Francis et al., 2004). Indeed, the questionnaire is often criticised for being long in duration, tiring and repetitive (Darker & French, 2009; French, Cooke, Mclean, Williams & Sutton, 2007).

Of the TPB-based research that has been conducted using child samples aged between 9-14 years most have been applied to a range of health-related behaviours including physical activity (Martin, McCaughy & Shen, 2009; Foley et al., 2008; Rhodes, Macdonald & McKay, 2006; Trost et al., 2002), smoking (McMillan, Higgins & Conner, 2005) and breastfeeding (Giles et al., 2007). Despite these studies, few to date have commented or reported on the psychometric properties of the TPB constructs, whilst those that have note low to moderate internal consistencies for some constructs, particularly the construct of perceived behavioural control (PBC) (Martin et al., 2009; Foley et al., 2008; Giles et al., 2007; Trost et al., 2002). Moreover, despite recommendations by Ajzen (2006 and 2002) and Francis et al. (2004) that an elicitation study be conducted to develop the indirect items for all TPB constructs and that the questionnaire be piloted to assess clarity of items, most applications have employed direct items only (Martin et al., 2009; Foley et al., 2008; Rhodes et al., 2006; McMillan et al., 2005; Trost et al., 2002), while few have adhered to the piloting guidelines (Foley et al., 2008; Giles et al., 2007; Trost et al., 2002). Further, these studies provide mixed support for the efficacy of the theory in predicting and understanding behaviour, with studies supporting the utility of the TPB where variances ranging from 35% to 79% have been explained (Giles et al., 2007; Foley et al., 2008; Rhodes et al., 2006; McMillan et al. 2005), while others acknowledge limited support for the TPB. For example, Martin et al. (2009) and Trost et al. (2002) report associations between the TPB and behaviour as weak, based on the lack of explanatory power between physical activity intention and TPB constructs, 10% and 8% respectively. However, limitations are apparent

including the use of convenience sampling, small samples, employment of cross-sectional study designs, use of self-reporting, and warrant further investigation.

One area which has received little application of the TPB is oral health, and in particular child oral health. Statistics illustrate that Northern Ireland (NI) has the poorest levels of oral health in the United Kingdom (UK) with its children in fact suffering the highest levels of dental caries in Europe (Department of Health, Social Services and Public Safety; DHSSPS, 2007). There is evidence that poor oral health has a negative effect on physical and psychological health, and quality of life. Those with poor oral health are more likely to have reduced quality of life (Watt, 2005; WHO, 2003), experience pain and suffering (Nuttall et al., 2006), feel embarrassment and have low self-esteem (Agou, Locker, Streiner & Thompson, 2008), encounter problems with eating, chewing and smiling, and have sleepless nights (Petersen, Bourgeois, Ogawa, Estupinan-Day & Ndiaye, 2005; WHO, 2003). Over the past decade considerable prominence has been given to the promotion of and the encouragement to adopt and sustain, appropriate self-care oral hygiene habits, particularly tooth brushing. These activities, on a daily basis, are necessary to keep the mouth clean and healthy and to maintain good oral health. This can be achieved by frequent and meticulous tooth brushing. Tooth brushing, whereby an individual uses a toothbrush along with toothpaste and water to clean his/her teeth is the most effective and practised form of self-care oral hygiene. It is recommended that both children and adults brush their teeth and gums twice daily, for at least two minutes, using fluoridated toothpaste in order to deter the onset of dental caries and periodontal disease (Levin and Currie, 2009).

These detrimental effects of poor oral health call for an understanding of the determinants of childrens tooth brushing behaviour, in order to provide evidence for developing effective interventions designed to encourage good oral practices. Given this and the lack of previously validated TPB scales for use among children, the purpose of this study was to devise and

report the development of a TPB measure suitable for use among children of primary school age to explore the attitudes and motivations of schoolchildren living in NI towards brushing their teeth. Whilst the paper will report and describe the processes involved in the context of oral health, it is hoped that it will provide opportunity for replication in future studies and offer a useful template for others wishing to employ the theory with child populations.

In line with the recommendations of Francis et al. (2004) and in keeping with previous research in the area of children's oral health (Dental Health Foundation, 2006), both qualitative and quantitative research methodologies were employed. Specifically, this study adopted a mixed-method sequential design (Sandelowski, 2000) and was conducted in three distinct phases: (1) an elicitation study to explore tooth brushing behaviour from a qualitative perspective and to identify the underlying beliefs; (2) construction of a TPB questionnaire to measure all beliefs elicited; and (3) a pilot test of the questionnaire to assess its psychometric properties.

### **Phase 1: Elicitation Study**

#### *Aim*

The aim of this phase of the research was to elicit the underlying beliefs influencing tooth brushing behaviour from the target group, with the overarching objective to facilitate the design of a questionnaire measure containing indirect items based on these salient beliefs. The population (schoolchildren) and the behaviour of interest (tooth brushing intention) were defined in accordance with the theory's TACT principality (i.e. target, action, context and time) (Ajzen, 2006 and 2002; Francis et al., 2004).

Despite consensus about the need for an elicitation study to determine the modal salient beliefs associated with the target behaviour (Francis et al., 2004), disagreements remain as to the most effective approach to adopt. For example, while both Ajzen and Fishbein (1980) and Francis et al. (2004) advocate open-ended questions aimed at encouraging full and meaningful answers based on an individual's knowledge and opinions, researchers have applied various methodologies, including qualitative focus groups and individual interviews, and quantitative surveys. However, it is argued that qualitative methodology offers a unique insight into individual views, thereby providing a more complex understanding of attitudes and knowledge regarding a particular behaviour (Silverman, 2000). Moreover, focus groups in particular can help people to explore and clarify views in ways that would be less easily accessible by other methods, such as quantitative surveys (Morgan, 1998). This seems particularly true when information is to be gleaned from young people and most researchers now promote the need for children to be targeted directly as the most adequate source of information about children is children themselves (Gill, Stewart, Treasure & Chadwick, 2008). Therefore, as qualitative methodologies do not require any standard of literacy skills on the part of participants (Stewart, Gill, Chadwick & Treasure, 2008), focus group methodology was deemed most appropriate for this research stage.

### *Sampling*

Given the target group a list of all primary schools in Northern Ireland was gained from the Department of Education NI (DENI) website. The sample sought to be representative of each of the five Education and Library Boards (ELB) in Northern Ireland. In addition, the sample aimed to include schools representative of children from different socio-economic groups based on the extent of receipt of free school meals. The DENI uses free school meal (FSM)



entitlement as a social indicator of deprivation, a state that is based on an aggregate level measure of relative poverty, low income and social disadvantage. Therefore, those schools receiving higher numbers of free school meals are reckoned to have a greater number of children from correspondingly deprived backgrounds (DENI, 2009).

The list of schools was stratified by both ELB and socio-economic group, and a stratified random sampling technique was employed to select schools to contact. Assuming a response rate in the region of 25% to 30% for research of this nature (de Vaus, 2002), contact was initially made with 20 primary schools, comprising four from each ELB, care being taken to ensure that, within each ELB, a range of FSM percentages were selected. A letter detailing the aims, objectives and procedures of the study, along with an invitation to participate, was posted to each of the selected schools. Of the 20 schools contacted, nine replied with seven agreed to participate. The schools agreeing to participate were provided with both parent and pupil information sheets and consent/assent forms, and asked to select eight pupils representing both genders and a range of academic abilities within their year six class.

### *Participants and Procedure*

Semi-structured focus groups were conducted in seven schools with eight pupils participating per school, involving a total of 56 children aged 9-10 years. Of those taking part, 26 were boys and 30 girls.

In keeping with Ajzen's (2006) guidelines, a series of open-ended questions were used to structure the focus group sessions which explored the attitudinal, normative and control beliefs influencing the target behaviour. As these guidelines are intended for adult populations it was necessary to adapt questions to be suitable for schoolchildren. Thus, to

elicit the beliefs underlying attitude, respondents were asked the following questions: ‘Why do you think it is important to brush your teeth’ and ‘What do you think would happen if you didn’t brush your teeth’. To elicit the beliefs underlying the normative component of the TPB, the following questions were asked: ‘Who do you think would want or like you to brush your teeth’ and ‘Whose opinion matters most’. Finally, with respect to control beliefs, respondents were asked: ‘What would make you brush your teeth’ and ‘What stops you or makes it difficult for you to brush your teeth’.

Each focus group was conducted as per procedures suggested by Gibson (2007) and lasted 30 to 45 minutes. At the commencement of each focus group the moderator (JD) introduced herself, explained both the project and the format of the focus group, and welcomed any questions from participants. Following informal chat to put participants at ease, the inclusion of an icebreaker at the beginning of the session led into a fun activity, which involved identifying food and drinks that are good or bad for your teeth. This helped to ensure that the participants were relaxed and thinking about their tooth brushing behaviour, and acted as an aid to improving group dynamics by offering individuals the opportunity to speak which would, in turn, increase the self-confidence of the various members of the group. Following this introductory format, all focus groups were audio recorded and later transcribed verbatim.

### *Data Analysis*

In line with theory protocols, the focus group transcripts were analysed for the purpose of eliciting the indirect (belief-based) measures. Focus group discussion recordings were transcribed verbatim. Data were thematically content analysed (Miles & Huberman, 1994) by two analysts (JD and MMCL). Transcribed data were read and re-read enabling the analysts to become immersed, and able to extract data inductively. Data were organised into

emerging behavioural, normative and control beliefs. The two analysts then compared beliefs until consensus was agreed.

### *Results*

#### General Findings:

Overall the sample was generally knowledgeable about their tooth brushing and aware of the issues surrounding the importance of maintaining good oral health standards. Of those sampled, all reported to brush their teeth every day, either in the morning, after school or before bed - and were conscious that they should brush their teeth for one to two minutes. General consensus was that participants enjoyed tooth brushing; however a minority of children did not like brushing their teeth for various reasons.

#### Behavioural Beliefs:

Participants were aware of the importance of tooth brushing. For example, some viewed healthy teeth as an integral part of good oral health, particularly related to aesthetic reasons.

“Because if you have your adult teeth, they last longer and you need to make sure they don’t fall out because when your adult teeth fall out you don’t have any more teeth so you need to take really good care of them.”

Others were mindful of the benefits of consuming a healthy diet, particularly one low in sugar.

“Eating healthy can help our teeth, you need to eat good stuff because if you don’t then your teeth would be bad.”

With respect to disadvantages, participants were aware that if they failed to brush their teeth, their teeth may rot and fall out, they could experience pain, or suffer from bad breath. Furthermore, visiting the dentist was elicited as a consequence of not brushing teeth, which was viewed negatively.

“If you didn’t brush your teeth you would have to go and see the dentist and get fillings.”

“The dentist would have to take your teeth out.”

For some, not brushing their teeth was linked with experiences of bullying. For example, concerns were expressed that if they had unhealthy teeth they might be teased.

“If you didn’t brush your teeth then you would have no teeth as they would fall out and people would get called gummy and get bullied.”

#### Normative Beliefs:

When asked if there were people who want them to brush their teeth, specific reference was made to mums, dads, family, friends, dentist, teacher and principal. Their mothers were regarded as the most influential significant other and, outside of the family, the dentist.

Despite this, to varying degrees, the majority of participants were of the opinion that they were personally responsible for their tooth brushing where the data gave a very clear picture of tooth brushing as a habitual behaviour.

“I just encourage myself to do it.”

“It is something you have to do so you just learn to do it.”

### Control Beliefs:

Factors thought to encourage tooth brushing included the resources that children use (i.e. toothbrush, toothpaste and timing devices), previous negative experience of visiting the dentist, vanity (i.e. appearance), and reinforcement.

“I brush my teeth so that I don’t have to visit the dentist for treatment.”

“I brush my teeth because I want to look nice, although I wouldn’t tell anyone that is the reason.”

“When I brush my teeth I have a chart and I get a sticker for brushing my teeth, if I fill up all of my sticker chart then I get a wee prize.”

Factors that might make it difficult to brush teeth were being organised to find the time, being tired and/or lazy, forgetting, and absence of sufficient or suitable resources.

## **Phase 2: Development of Measure**

### *Aim*

The aim of this phase of the research was to develop the questionnaire measure. Thus, once the modal salient beliefs towards tooth brushing had been elicited, these were used to construct the items of the questionnaire measure (see Table 1).

- Insert Table 1 About Here -

### *Measure*

There are a series of recommended steps that a researcher must employ when designing a TPB-based measure (see Fishbein & Ajzen, 2010; Ajzen, 2006; Francis et al., 2004; Ajzen,

2002). Once the population of interest (school children), and the behaviour under investigation (tooth brushing), have been defined in terms of the TACT principle, a general introductory statement for the questionnaire is developed: 'Brushing teeth every morning and every evening this coming week'. The next step is to determine how to assess each of the TPB constructs.

Researchers employing the TPB have been divided in their use of either five-point (Trost et al., 2002) or seven-point Likert scales (Buunk-Werkhoven, Dijkstra & van der Schans, 2011; Bonetti et al., 2010; Martin et al., 2009; Luzzi & Spencer, 2008; Lavin & Groarke, 2005). All of the items included in this measure were designed using the five-point Likert scale, as recommended by Ajzen (1991) and Ajzen & Fishbein (1980). Further, regardless of whether researchers have used five or seven point response formats – the options are typically numbered and generally labelled. However, taking account of the anticipated cognitive ability of the target population, i.e. style, ability, sensitivities, and level of comprehension and abstraction (Kennedy, Kools & Krueger, 2001), it was considered that questionnaire completion would be aided by an easier and more age-appropriate pictorial rating format of responses. As such, these were designed to be consistent with the InCAS (Interactive Computerised Assessment System), a diagnostic and adaptive computer-based assessment method that schoolchildren aged five to eleven years use a part of the NI school curriculum (see Table 2).

- Insert Table 2 About Here -

Once the response formats had been decided upon, the next step was to design items to assess each of the indirect measures of the TPB constructs. Much debate surrounds the manner in which the indirect measures are operationalised, exemplified by conflicting opinions as to whether item responses should follow unipolar (1 to 5) or bipolar (-2 to +2) scaling. To

ensure coding consistency across the constructs, optimal scaling was used following the technique advocated by Ajzen (2006 and 1991) and widely adopted by others (Newton, Ewing, Burney and Hay, 2012; McMillan et al., 2009; O'Sullivan, McGee and Keegan, 2008; French and Hankins, 2003) whereby scoring is based upon the system (i.e. unipolar or bipolar) that maximises the correlation between the expectancy and evaluative components.

The indirect measures were based on 11 outcome evaluations and the corresponding behavioural beliefs. As such, respondents were first required to evaluate each outcome, on a very good (5) to very bad (1) dimension. They were then required to indicate the likelihood that each of these outcomes would occur if they were to brush their teeth, for example across very true (5) to very untrue (1). Outcome evaluations were then multiplied by the corresponding behavioural beliefs, and the summed product served as the belief-based measure of attitude.

The belief-based measure of subjective norm was derived from the expectations of six referents: mummy, daddy, other members of my family, dentist, friends and teacher/principal. Respondents were first required to indicate the extent to which each of their significant others would endorse their intention to brush their teeth. This was followed by a request to indicate the extent to which they were motivated to comply with the wishes of their significant others, across a five-point Likert scale, ranging from strongly agree (5) to strongly disagree (1). Again, each normative belief was multiplied by the corresponding motivation to comply, and the summed product served as an indirect measure of subjective norm.

The belief-based measure of control was grounded on the seven beliefs elicited from the focus group discussions, and measured using single items. Respondents were required to indicate the extent to which each of the beliefs would encourage them to, or prevent them from, brushing their teeth using a very true (5) to very untrue (1) Likert scale.

### **Phase 3: Exploration of the Psychometric Properties**

#### *Aim*

The aim of phase three of the research was to pilot the questionnaire to identify any issues regarding clarity, readability and completion, and to test the psychometric properties of the questionnaire measure, thus providing evidence to confirm that the measure developed from the elicitation study was suitable for use with schoolchildren.

#### *Participants and Procedure*

One hundred and eighty-four, year six schoolchildren (aged 9-10) attending seven primary schools across Northern Ireland participated in the pilot study (the same seven schools who participated in Phase 1). Of these, 95 were boys and 89 girls. Questionnaire administration by the research team lasted between 45-60 minutes, and was administered within a teaching context in the classroom, along with a PowerPoint presentation. Following completion of the questionnaires a series of questions was employed to evaluate the questionnaire (Francis et al., 2004). Additionally, a repeated measure design was employed using test re-test reliability analysis, where the questionnaire was re-administered three weeks later to 97 of the respondents. A matching technique, using respondent date of birth, was incorporated within the questionnaire to aid this process.

#### *Data Analysis*

The data was analysed in two steps. Initially, reliability analysis tested the internal consistency, and test-retest analysis consisted of Pearson correlations. Then, to examine the



utility of the TPB, analysis consisted of Pearson correlations and regression analysis exploring the relationship between TPB constructs and the prediction of intention.

### *Results*

#### General Evaluation:

In accordance with the advice of Francis et al. (2004) a series of questions was employed to evaluate the questionnaire. For example, respondents were asked to identify items that were difficult to answer or any discrepancies within the questionnaire. Although some of the respondents were unsure of how often they visited the dentist and therefore were limited to selecting response option 'not sure', no items specifically related to the TPB were identified. Of the sample, 74% enjoyed completing the questionnaire and found its layout easy to follow. However, 26% thought the questionnaire too long in duration, while 22% found the questions difficult to answer. Although it was anticipated that respondents would find the questionnaire long in duration, 85% found the presentation easy to follow and understand thereby supporting the decision to include it as an aid to completion of the questionnaire.

#### Reliability Analysis:

Cronbach's alpha coefficients were calculated to establish reliability estimates for the scales of measurement, which ranged from  $\alpha = 0.75$  to 0.85 and so demonstrated high levels of internal consistency for the questionnaire items (see Table 3).

- Insert Table 3 About Here -

To establish the significance of the test-retest reliability scores, Pearson product moment correlations were estimated. In accordance with Landis & Koch (1977) a significant relationship at the .01 level was achieved for all ten of the direct and indirect TPB constructs, with intention having perfect agreement, and the remaining constructs all attaining substantial to almost perfect agreement levels. Specifically, the indirect measures: outcome evaluation ( $r=.75$ ), behavioural beliefs ( $r=.849$ ), normative beliefs ( $r=.766$ ), motivation to comply beliefs ( $r=.636$ ) and control beliefs ( $r=.627$ ) were significantly correlated at both test and retest stages (all  $ps < .01$ ,  $p=.00$ ). The direct measures of attitude ( $r=.851$ ), intention ( $r=1.0$ ), self-efficacy ( $r=.848$ ), PBC ( $r=.754$ ) and subjective norm ( $r=.841$ ) were also strongly correlated across test and retest scores (all  $ps < .01$ ,  $p=.00$ ).

#### Prediction of Intention:

Correlation analyses were conducted to explore the relationship between intention and each of the measured variables (see Table 4). The most significant correlation with tooth brushing intention was self-efficacy, followed by attitude and subjective norm. Perceived behavioural control, however, failed to correlate significantly with tooth brushing intention.

These relationships were further confirmed in a subsequent regression analysis where 66% of the variance in tooth brushing intention was explained by the TPB [ $F(4, 176) = 86.57$ ,  $p < 0.01$ ;  $\beta = 0.715$  self-efficacy),  $\beta = 0.156$  (subjective norm),  $\beta = 0.091$  (attitude),  $\beta = 0.087$  (PBC).

- Insert Table 4 About Here -

## Discussion

### Main finding of this study

The overriding aim of this study was to develop and test a TPB based measure suitable for use with primary schoolchildren aged 9-10 years. In this respect, the questionnaire proved reliable with the analysis providing strong support for its psychometric properties. Further analyses reinforced the predictive utility of the TPB and the evaluation led to only minor word-formatting of the measure.

### What is already known on this topic

The TPB has emerged as a popular conceptual framework for the study of human behaviour, with a plethora of supportive evidence having been obtained for the efficacy of the model as a predictor of both intention and behaviour, as well as a framework for the design and evaluation of health behaviour-change interventions. Despite this, a lack of TPB-based research with children under 13 years exists. Reasons for this include it being a difficult model to operationalise (Francis et al., 2004) and the questionnaire being long in duration, tiring and repetitive (Darker & French, 2009; French, Cooke, Mclean, Williams & Sutton, 2007). Of the TPB-based research that has been conducted using child samples aged between 9-14 years, few comment on the psychometric properties of the theory constructs, whilst those that have note low to moderate internal consistencies (Martin et al., 2009; Foley et al., 2008; Giles et al., 2007; Trost et al., 2002).

### What this study adds

The findings provide evidence for the content validity, internal consistency, stability reliability, and construct validity of a TPB measure suitable for use among primary schoolchildren. Evidence of content validity was supported by a sub-sample of schoolchildren who generally referred to the completion of the questionnaire as enjoyable and

simplistic. Internal consistency reliabilities of the subscales yielded high levels, ranging from .75 to .85. Results of the test-retest indicate that the subscales of the measure are reliable over a three-week period, as high temporal stability with substantial to perfect agreement levels were achieved (Landis & Koch, 1977).

In addition, this study has reinforced the suitability of the TPB with children. It has been frequently documented that children experience difficulties with completing TPB-based questionnaires, specifically surrounding the understanding of semantic differential and numeric Likert scaling (Rhodes et al., 2006). In fact, those studies that have been conducted with child populations, often report low to moderate internal consistencies for TPB constructs (Martin et al., 2009; Foley et al., 2008; Trost et al., 2002; Mummery, Spence & Hudec, 2000). This study has helped to address these problems via the development of a child-friendly and psychometrically tested and validated TPB measure, something which can extend current literature. Further, it has also provided evidence for the utility of the TPB to predict tooth brushing intention as the theory was found to explain 66% of the variance, suggesting that the model is working well. Of particular interest is the finding that all of the TPB constructs contributed significantly, albeit to varying extents, to the prediction of intention, thereby providing support for the applicability of the theory, i.e. that tooth brushing intentions among NI's schoolchildren can be assessed successfully using the constructs of the TPB. In fact, the unique contribution of the models components to the prediction of intention exceeds that of other studies using the theory with children (Martin et al., 2009; Foley et al., 2008; Trost et al., 2002) where between 10% and 56% of the variance was explained.

One possible explanation for the promising psychometric properties reported in this study could be the meticulous preparation of the questionnaire's development. For example, TPB recommendations proposed by Francis et al. (2004) and Ajzen (2006 and 2002) were adhered to, which in turn, may have led to effectiveness of the questionnaire's content validity. When

developing a TPB-based questionnaire it has been suggested that formative research be conducted to prepare the questionnaire as TPB constructs are internal processes that cannot be directly observed but must be understood from self-reports (Francis et al., 2004; Ajzen, 2002). To gain such an understanding, exploratory work using focus groups methodology was conducted in order to identify the modal salient beliefs (indirect measures) underlying the behaviour. Not only did this elicitation study identify those behavioural issues central to the population, more importantly it also provided understanding of the appropriate language and style required to design the TPB items. As such, the findings achieved in this research stage reiterate the importance of carrying out exploratory work when applying the TPB, not only to determine the modal salient beliefs associated with the behaviour under investigation but also to identify practical issues that might be salient for the population which seems to be of particular importance in the context of children.

As TPB-based questionnaires are typically referred to as problematic (Darker & French, 2009; French et al., 2007; Rhodes et al., 2006) it was decided to encompass a variety of interactive resources into the research design. For example, game play was included in the focus group discussions to get children enthusiastic, engaged and actively thinking about their tooth brushing behaviour. In addition, the use of both child-friendly imagery and a PowerPoint presentation made self-administration of the questionnaire exciting, attractive, and enjoyable to complete. Such positive findings affirm the effectiveness of incorporating interactivity into research methodology with children, consistent with others who reported such resources to be successful (Giles et al., 2013; Dental Health Foundation, 2006; Friel, Hope, Kelleher, Comer & Sadlier, 2002). Limitations of this study

Despite careful scrutiny of TPB recommendations (Ajzen, 2006 and 2002; Francis et al., 2004) and the favourable findings achieved, there are limitations that need to be considered when interpreting the results. First, the way in which the behaviour was operationalised

using the TACT principle is problematic. Children were asked how likely it is that you will brush your teeth every morning and every evening this coming week, which with hindsight, requiring children who typically live in the here and now to conceptualise ‘this coming week’ was perhaps too long and could have increased the likelihood of them responding more positively, suggesting more immediate timeframes are needed. Moreover, the introductory statements within the questionnaire were based on the assumption that respondents were going to brush their teeth every morning and evening. In future, it might therefore be advisable to define the behaviour by referring to immediate time, i.e. every day (Martin et al., 2009).

## Conclusions

In conclusion, this study extends the prior literature concerning applications of the theory with child populations by first, conducting this preliminary TPB research with children under thirteen years old and second, reporting both the development and testing procedures. The theory has proved to be a useful framework for assessing self-reported tooth brushing, and further supports the applicability of the TPB with a child sample. This article describes the first three phases of a TPB-based study namely the elicitation study; questionnaire construction; and piloting. Given the recommendations that oral health promotion should form part of the school curriculum (see DHPSS, 2007; Kwan et al., 2005; WHO, 2003) the fourth phase of this study will be to utilise this questionnaire in a cross-sectional study of schoolchildren, with the aim of informing the design of an educational tooth brushing intervention.

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## References

- Adair, P. M., Burnside, G., & Pine, C. M. (2013). Analysis of Health Behaviour Change Interventions for Preventing Dental Caries Delivered in Primary Schools. *Caries Research*, 47(1), 2-12. doi: 10.1159/000351829
- Agou, S., Locker, D., Streiner, D., & Thompson, B. (2008). Impact of self-esteem on oral health related quality of life of children with malocclusion. *American Journal of Orthodontics and Dentofacial Orthopedics*, 134, 484-489. doi: 10.1016/j.ajodo.2006.11.021
- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl, & J. Beckman (Eds.), *Action-Control: From Cognition to Behavior* (pp. 11-39). Heidelberg, Germany: Springer.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behaviour and Human Decision Processes*, 50, 179-211.
- Ajzen, I. (2002). *Constructing a Theory of Planned Behavior Questionnaire*. Retrieved from <http://people.umass.edu/aizen/pdf/tpb.measurement.pdf>
- Ajzen, I. (2006). *Constructing a TPB Questionnaire: Conceptual and Methodological Considerations*. Retrieved from <http://www.unix.oit.umass.edu/~ajzen/pdf/tpb.measurement.pdf>, 2006.
- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting human behavior*. Englewood Cliffs, NJ: Prentice-Hall.
- Armitage, C., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*, 40(4), 471-499.

Bonetti, D., Johnston, M., Clarkson, J. E., Grimshaw, J., Pitts, N. B., Eccles, M., Steen, N., Thomas, R., MacLennan, G., Glidewell, L., & Walker, A. (2010). Applying psychological theories to evidence-based clinical practice: identifying factors predictive of placing preventive fissure sealants. *Implementation Science*, 5(25), 1-14. doi: 10.1186/1748-5908-5-25

Buunk-Werkhoven, Y. A. B., Dijkstra, A., & van der Schans, C. P. (2011). Determinants of oral hygiene behaviour: a study based on the theory of planned behaviour. *Community Dentistry and Oral Epidemiology*, 39, 250-259. doi: 10.1111/j.1600-0528.2010.00589

Darker, C. D., & French, D. P. (2009). What sense do people make of a theory of planned behaviour questionnaire? A think-aloud study. *Journal of Health Psychology*, 14(7), 861-871. doi: 10.1177/1359105309340983

Dental Health Foundation. (2006). *Winning Smiles: School Oral Health Promotion Programme for 7-8 year olds*. Dublin: Dental Health Foundation.

Department of Health, Social Services and Public Safety. (2007). *Oral Health Strategy for Northern Ireland*. Belfast: DHSSPS.

Fishbein, M., & Ajzen, I. (2010). *Predicting and Changing Behaviour: The Reasoned Action Approach*. New York: Taylor and Francis Group.

Foley, L., Prapavessis, H., Maddison, R., Burke, S., McGowan, E., & Gillanders, L. (2008). Predicting Physical Activity Intention and Behaviour in School-Age Children. *Pediatric Exercise Science*, 20, 342-356.

Francis, J. J., Eccles, M. P., Johnston, M., Walker, A., Grimshaw, J., Foy, Kaner, E. F. S., & Bonetti, D. (2004). *Constructing Questionnaires Bases on the Theory of Planned Behaviour: A Manual for Health Services Researchers*. Newcastle: Centre for Health Services Research.



- French, D. P., Cooke, R., Mclean, N., Williams, M., and Sutton, S. (2007). What Do People Think about When They Answer Theory of Planned Behaviour Questionnaires? A ‘Think Aloud’ Study. *Journal of Health Psychology*, 12(4), 672-687. doi: 10.1177/1359105307078174
- French, D. P., & Hankins, M. (2003). The expectancy-value muddle in the theory of planned behaviour – and some proposed solutions. *British Journal of Health Psychology*, 8, 37-55.
- Friel, S., Hope, A., Kelleher, C., Comer, S., & Sadler, D. (2002). Impact evaluation of an oral health intervention amongst primary school children in Ireland. *Health Promotion International*, 17(2), 119-126.
- Gibson, F. (2007). Conducting focus groups with children and young people: strategies for success. *Journal of Research in Nursing*, 12(5), 473-483. doi: 10.1177/1744987107079791
- Giles, M., Millar, S., Armour, C., McClenahan, C., Mallett, J., & Stewart-Knox, B. (2013). Promoting positive attitudes to breastfeeding: the development and evaluation of a theory-based intervention with school children involving a cluster randomised controlled trial. *Maternal and Child Nutrition*. doi: 10.1111/mcn.12079
- Giles, M., Conner, S., McClenahan, C., Mallet, J., Stewart-Knox., & Wright, M. (2007). Measuring young people’s attitudes to breastfeeding using the Theory of Planned Behaviour. *Journal of Public Health*, 29(1), 17-26. doi: 10.1093/pubmed/fdl083
- Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Conducting qualitative interviews with school children in dental research. *British Dental Journal*, 204(7), 371-374. doi: 10.1038/sj.bdj.2008.245
- Godin, G., & Kok, G. (1996). The theory of planned behaviour: A review of its applications to health-related behaviours. *American Journal of Health Promotion*, 11, 87-98.

- Gratton, L., Povey, R., & Clark-Carter, D. (2007). Promoting children's fruit and vegetable consumption: Interventions using the Theory of Planned Behaviour as a framework. *British Journal of Health Psychology*, 12(4), 639-650. doi: 10.1348/135910706X171504
- Hardeman, W., Johnston, M., Johnston, D.W., Bonetti, D., Wareham, N.J. & Kinmonth A.L. (2002). Application of the theory of planned behaviour in behaviour change interventions: A systematic review. *Psychology and Health*, 17(2), 123-158. doi: 10.1080/08870440290013644a
- Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural Equation Modelling: Guidelines for Determining Model Fit. *The Electronic Journal of Business Research Methods*, 6(1), 53-60.
- Kennedy, C., Kools, S., & Krueger, R. (2001). Methodological considerations in children's focus groups. *Nursing Research*, 50(3), 184-187. doi: 10.1177/1744987107079791
- Kwan, S.Y.L., Petersen, P.E., Pine, C.M., & Borutta, A. (2005). Health-promoting schools: an opportunity for oral health promotion. *Bulletin of the World Health Organization*, 83(9), 677-685.
- Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, 33, 159-174.
- Lavin, D., & Groarke, A. (2005). Dental floss behaviour: A test of the predictive utility of the Theory of Planned Behaviour and the effects of making implementation intentions. *Psychology, Health and Medicine*, 10(3), 243-252. doi: 10.1080/13548500412331334127
- Levin, K. A., & Currie, C. (2009). Inequalities in tooth brushing among adolescents in Scotland 1998-2006. *Health Education Research*, 24(1), 87-97.
- Low, W., Tan, S., &

Schwartz, S. (1999). The effect of severe caries on the quality of life in young children. *Paediatric Dentistry*, 21(6), 325-326.

Luzzi, L., & Spencer, A.J. (2008). Factors influencing the use of public dental services: An application of the Theory of Planned behaviour. *BMC Health Services Research*, 8, 93-106. doi: 10.1186/1472-6963-8-93

Martin, J. J., McCaugtry, N., & Shen, B. (2009). Physical Activity and Fitness in Inner City Hispanic American Children. *Hispanic Health Care International*, 7(1), 21-29.

McMillian, B., Conner, M., Green, J., Dyson, L., Renfrew, M., & Woolridge, M. (2009). Using an extended theory of planned behaviour to inform interventions aimed at increasing breastfeeding uptake in primiparas experiencing material deprivation. *British Journal of Health Psychology*, 14, 379-403.

McMillan, B., Higgins, A. R., & Conner, M. (2005). Using an extended theory of planned behaviour to understand smoking amongst schoolchildren. *Addiction Research and Theory*, 13(3), 293-306. doi: 10.1080/16066350500053679

Miles, M., & Huberman, A. (1994). *Qualitative Data Analysis: an Expanded Source Book* (2<sup>nd</sup> ed.). Thousand Oaks, CA: Sage Publications.

Morgan, D. L. (1998). Planning focus groups. In D. L. Morgan, & R. A. Kreuger (Eds.), *The Focus Group Kit* (Volume 2). Thousand Oaks: Sage Publications.

Mummery, W. K., Spence, J. C., & Hudec, J. C. (2000). Understanding physical activity intention in Canadian school children and youth: An application of the theory of planned behavior. *Research Quarterly for Exercise and Sport*, 71, 116-124.

- Newton, J. D., Ewing, M. T., Burney, S., & Hay, M. (2012). Resolving the theory of planned behaviour's 'expectancy-value muddle' using dimensional salience. *Psychology and Health*, 27(5), 588-602.
- Nuttall, N. M., Steele, J. G., Evans, D., Chadwick, B., Morris, A. J., & Hill, K. (2006). The reported impact of oral condition on children in the United Kingdom, 2003. *British Dental Journal*, 200, 551-555. doi: 10.1038/sj.bdj.4813586
- O'Sullivan, B., McGee, H., & Keegan, O. (2008). Comparing solutions to the 'expectancy-value muddle' in the theory of planned behaviour. *British Journal of Health Psychology*, 13, 789-802. doi: 10.1348/135910708X278306
- Petersen, P.E., Bourgeois, D., Ogawa, H., Estupinan-Day, S., & Ndiaye, C. (2005). The global burden of oral diseases and risks to oral health. *Bulletin of the World Health Organization*, 83(9), 661-9.
- Rhodes, R. E., Macdonald, H. M., & McKay, H. A. (2006). Predicting physical activity intention and behaviour among children in a longitudinal sample. *Social Science and Medicine*, 62, 3146-3156. doi: 10.1016/j.socscimed.2005.11.051
- Silverman, D. (2000). *Doing Qualitative Research*. London: Sage Publications.
- Stewart, D., Sun, J., Patterson, C., Lemerie, K., & Hardie, M. (2004). Promoting and building resilience in primary school communities: evidence from a comprehensive 'health promoting school' approach. *International Journal of Mental Health Promotion*, 6, 26-33.
- Stewart, K., Gill, P., Chadwick, B., & Treasure, E. (2008). Qualitative research in dentistry. *British Dental Journal*, 204, 235-239. doi: 10.1038/bdj.2008.149

Trost, S. G., Pate, R. R., Dowda, M., Ward, D. S., Felton, G., & Saunders, R. (2002). Psychosocial Correlates of Physical Activity in White and African-American Girls. *Journal of Adolescent Health, 31*, 226-233.

Watt, R.G. (2005). Strategies and approaches in oral disease prevention and health promotion. *Bulletin of the World Health Organization, 83*(9), 711-717.

World Health Organization. (2003). *Oral Health Promotion: An Essential Element of a Health-Promoting School*. WHO Information Series on School Health Document Eleven. Geneva: World Health Organization.

Table 1 Indirect beliefs elicited about tooth brushing
<i>Behavioural Beliefs</i> Won't have toothache Will have strong teeth Won't have bad breath Will remove food from being stuck in my teeth Will have clean teeth Will stop teeth from rotting or falling out Will have a nice smile Won't have funny coloured teeth Won't have to visit the dentist Won't get sore gums Won't have a build-up of plaque
<i>Normative Beliefs</i> My mummy thinks I should brush my teeth My daddy thinks I should brush my teeth Other members of my family think I should brush my teeth My dentist thinks I should brush my teeth My friends thinks I should brush my teeth My teacher/principal think I should brush my teeth
<i>Perceived Control Beliefs</i> If I am tired I won't brush my teeth If I had nicer toothpaste I would brush my teeth more often Sometimes I can forget to brush my teeth If I got a treat for brushing my teeth I would brush my teeth more often I brush my teeth so I won't get bullied If I am in a rush I won't brush my teeth At the weekend, if I am staying at home I don't brush my teeth




Table 2 Pictorial rating Likert scales	
<i>Response Options</i>	<i>Meaning</i>
	Very Good, Good, Not Sure, Bad, Very Bad
	Strongly Agree, Agree, Not Sure, Disagree, Strongly Disagree
	Very True, True, Not Sure, Un-True, Very Un-True

Table 3 Direct measures of the Theory of Planned Behaviour

TPB Construct	<i>n</i> items	Sample item	Alpha coefficient
Intention	3	I am going to brush my teeth every morning and evening this coming week	0.79
Attitude	3	Brushing my teeth every morning and every evening this coming week will make me feel: Very Good – Very Bad	0.85
Subjective Norm	3	People who care about me would like me to brush my teeth every morning and every evening this coming week	0.75
PBC	3	It is mostly up to me whether or not I brush my teeth every morning and every evening this coming week	0.76
Self-efficacy	3	I am confident that I can brush my teeth every morning and evening this coming week	0.84

Table 4 Correlations between TPB variables.

<i>Variables</i>	Intention	Attitude	Subjective Norm	PBC	Self-efficacy
Intention	-				
Attitude	.525**	-			
Subjective Norm	.406**	.378**	-		
PBC	.115	.273**	.026	-	
Self-efficacy	.791**	.555**	.305**	.242*	-